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(54) **ELECTRONIC APPARATUS, POWER CONTROL OF ELECTRONIC APPARATUS AND MOVING METHOD OF FRONT PANEL OF ELECTRONIC APPARATUS**

(75) Inventors: **Hiroaki Fujita**, Saitama (JP); **Jun Shinkawa**, Saitama (JP)

(73) Assignee: **Pioneer Corporation**, Tokyo (JP)

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(51) **Int. Cl.**
G06K 13/00 (2006.01)

(52) **U.S. Cl.** **235/476**

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See application file for complete search history.

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Primary Examiner—Diane I. Lee
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

When a front panel is opened, a microcomputer decides that it reached a predetermined angle by counting the number of pulses generated by a pulse generator, and a CPU controls a power switch and turns off a power supplied to a card type record medium. Also, when the microcomputer detects an input of a front panel operation button in a state in which the front panel has opened and when a switch is ON, the CPU recognizes that the card type record medium is present and detects whether or not a terminal for connection detection of the card type record medium has been electrically connected and when it has not been connected, it is recognized that the card type record medium is in a half insertion state and a closing operation is not performed.

8 Claims, 9 Drawing Sheets

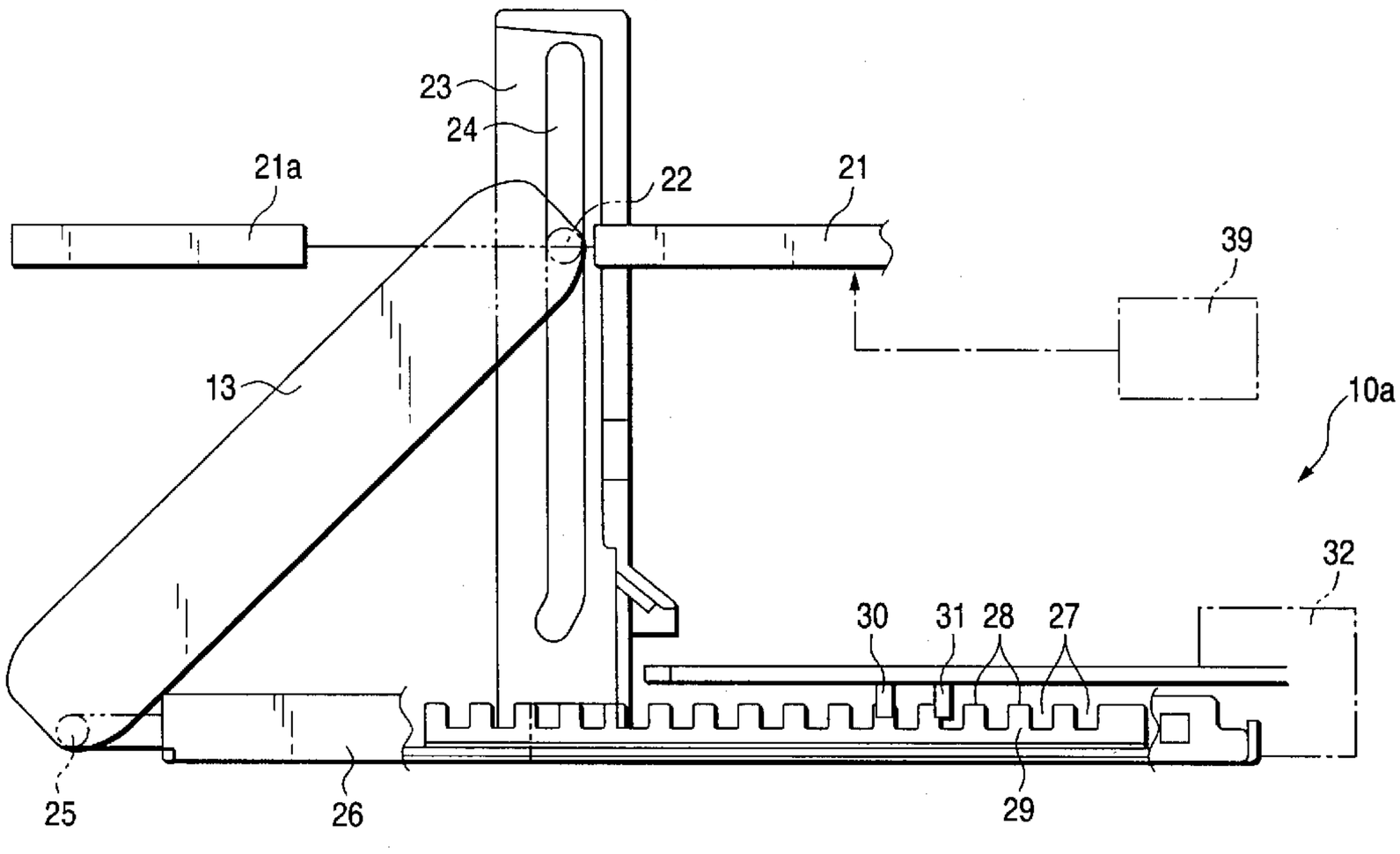


FIG. 1

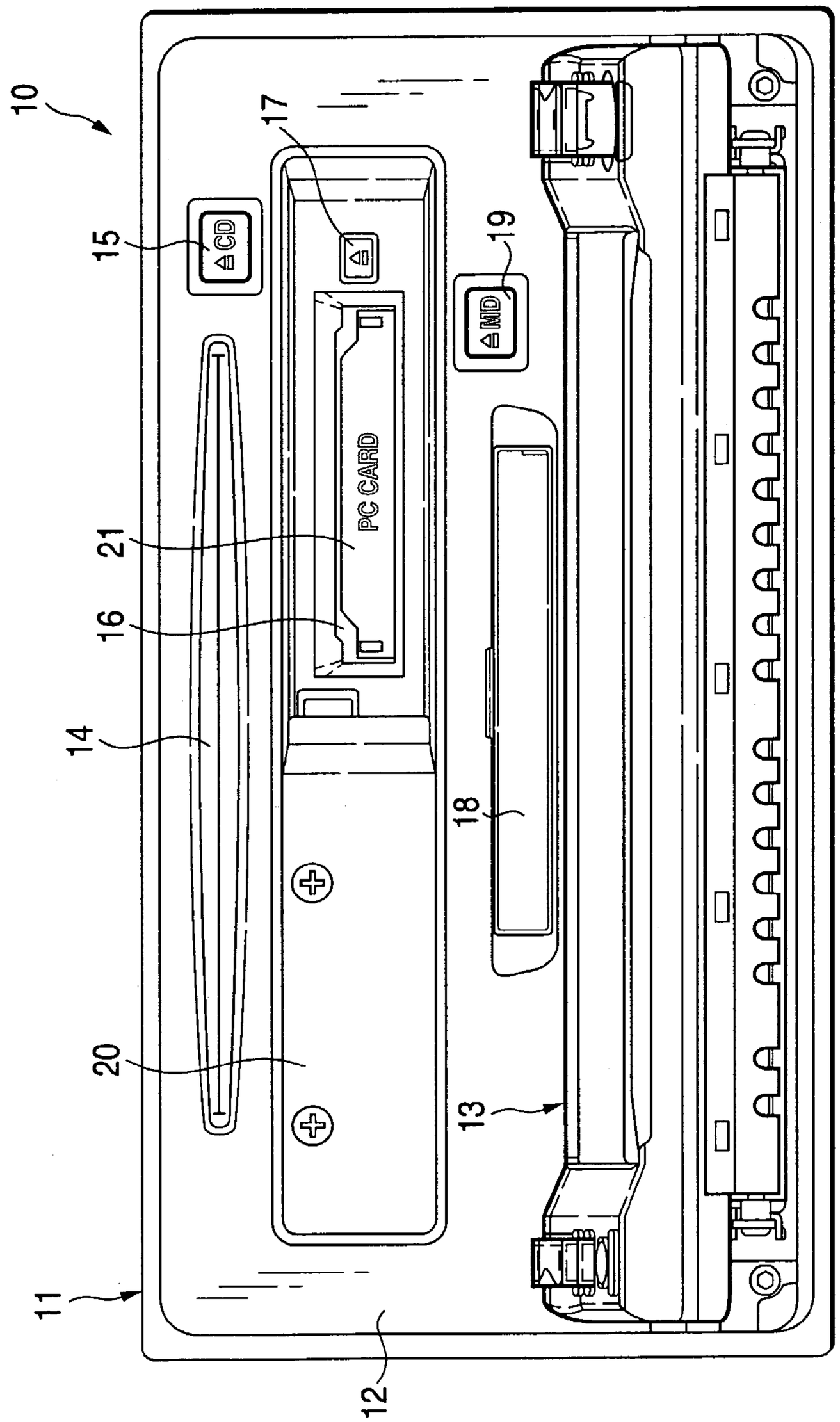


FIG. 2

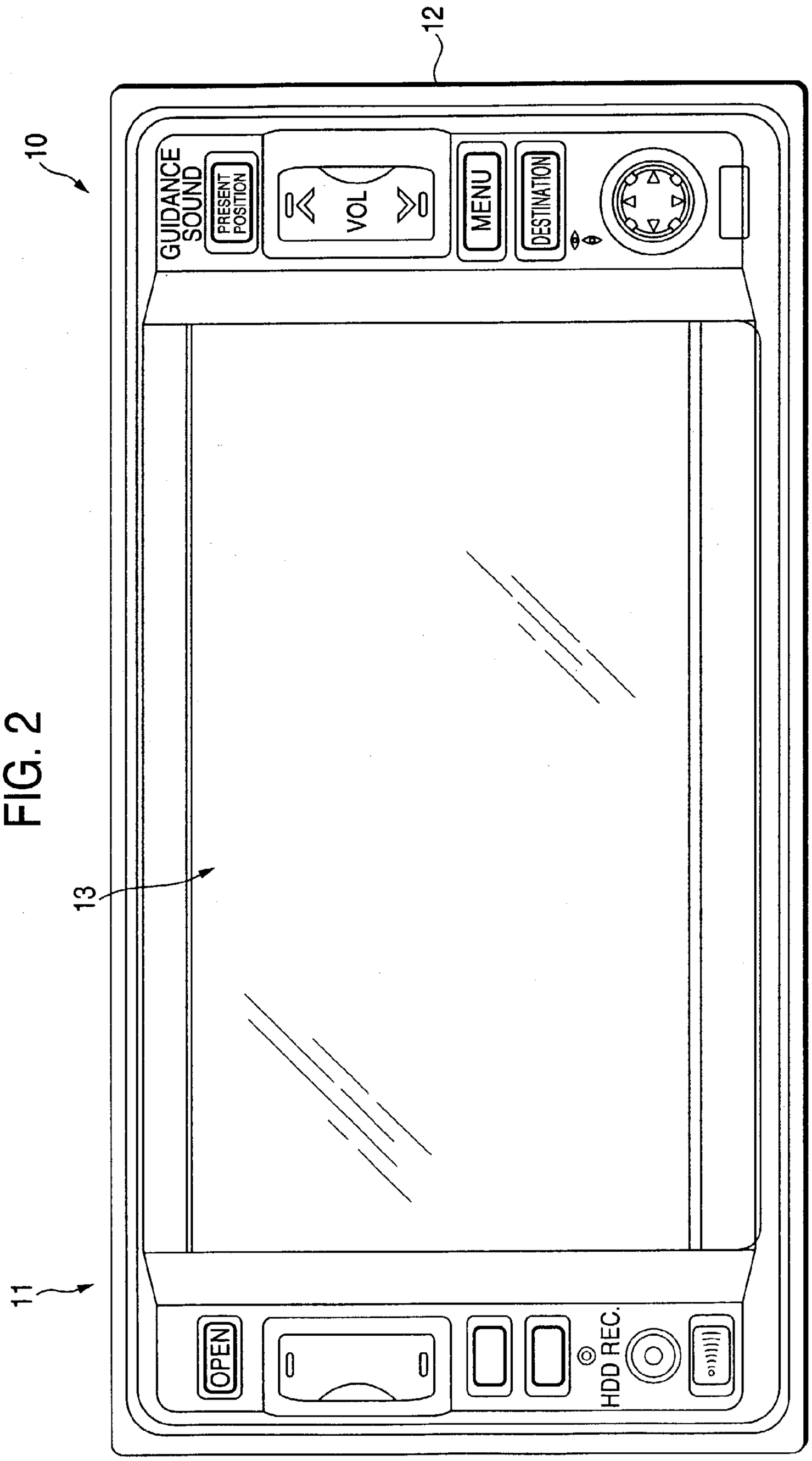

12
10
GUIDANCE SOUND
PRESENT POSITION
VOL
MENU
DESTINATION
13
11
OPEN
HDD REC.

FIG. 3

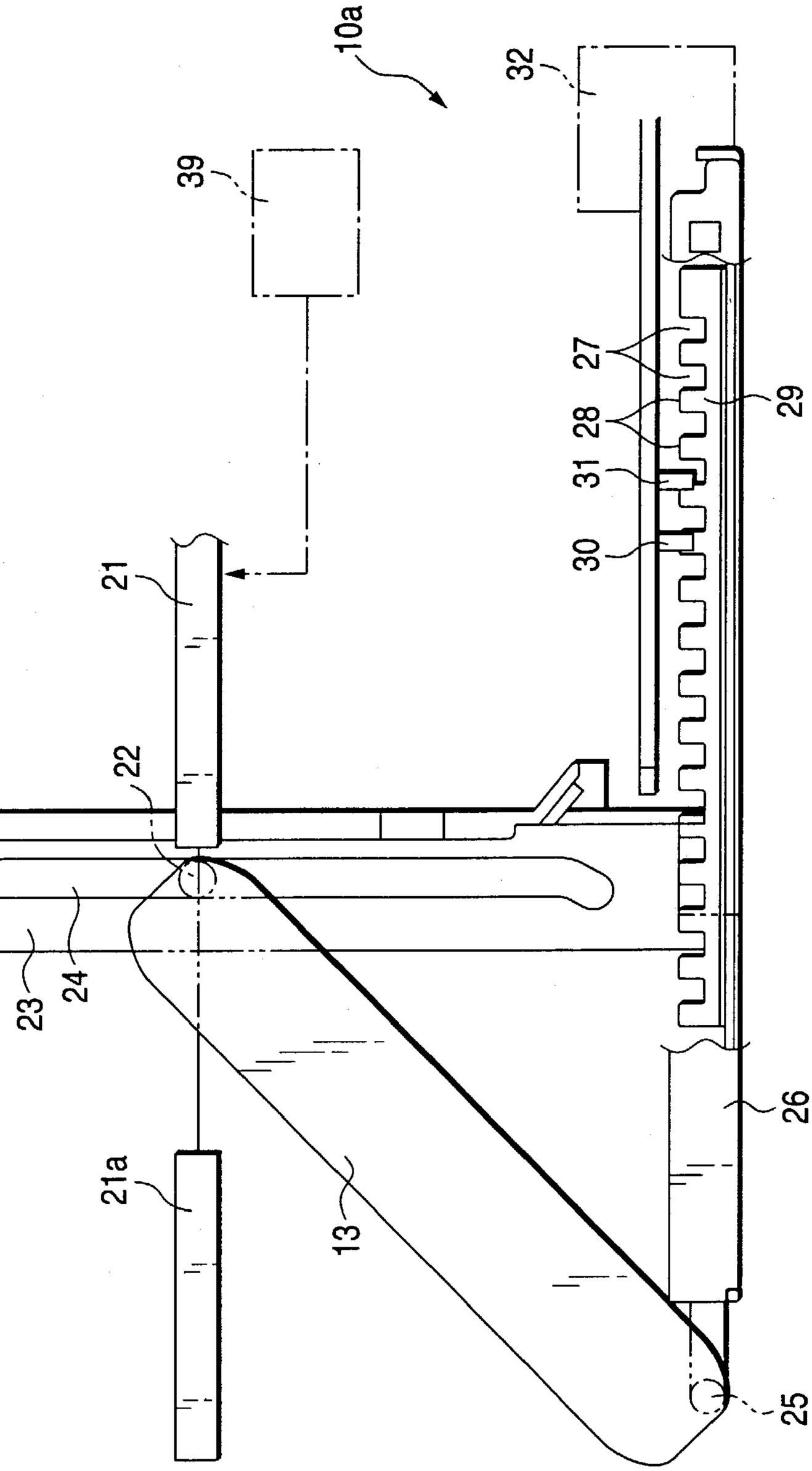


FIG. 4

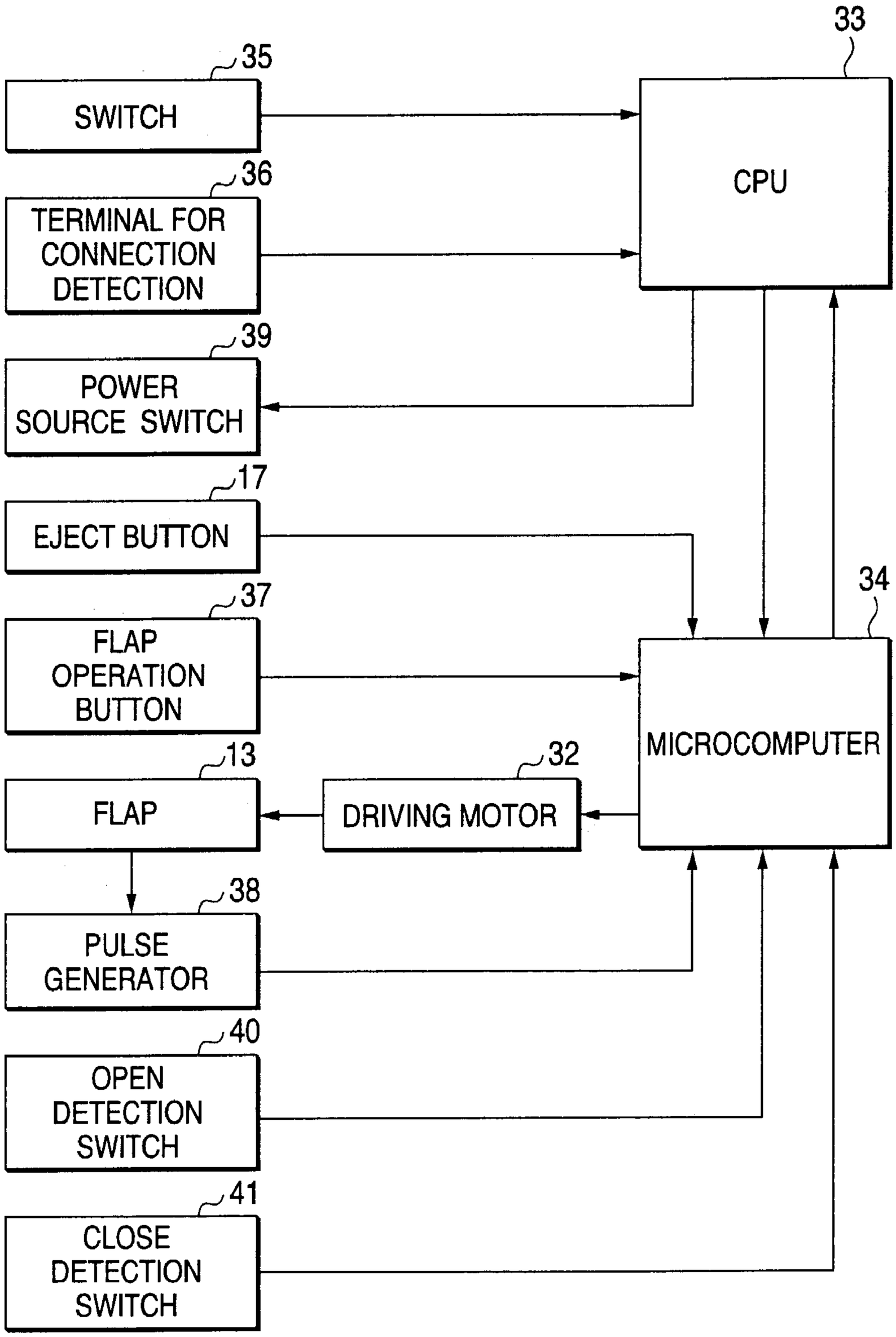

33
35
SWITCH
36
TERMINAL FOR CONNECTION DETECTION
39
POWER SOURCE SWITCH
17
EJECT BUTTON
37
FLAP OPERATION BUTTON
CPU
34
MICROCOMPUTER
13
FLAP
32
DRIVING MOTOR
38
PULSE GENERATOR
40
OPEN DETECTION SWITCH
41
CLOSE DETECTION SWITCH

FIG. 5

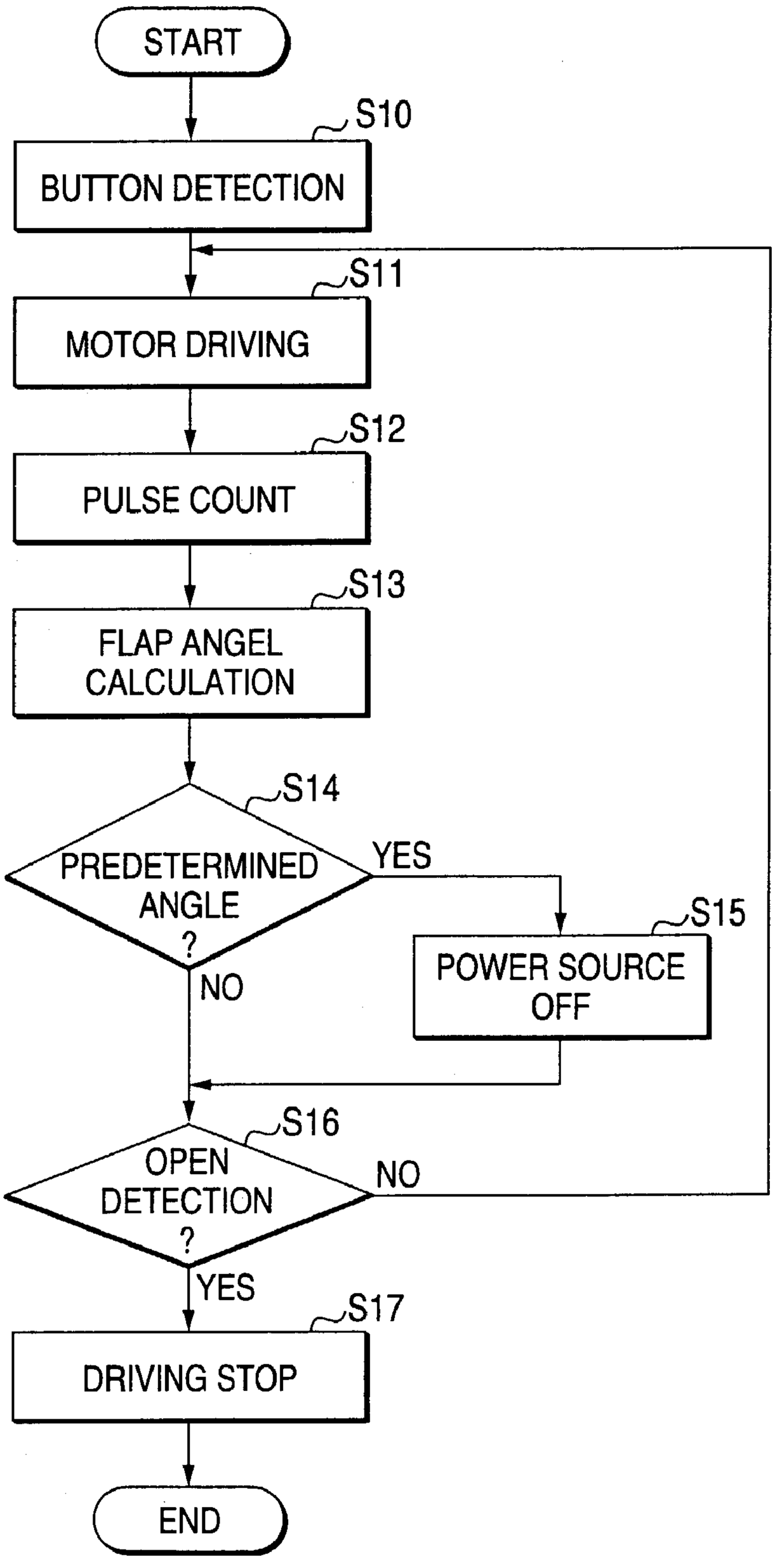

START
S10
BUTTON DETECTION
S11
MOTOR DRIVING
S12
PULSE COUNT
S13
FLAP ANGEL CALCULATION
S14
PREDETERMINED ANGLE ?
YES
NO
S15
POWER SOURCE OFF
S16
OPEN DETECTION ?
NO
YES
S17
DRIVING STOP
END

FIG. 6

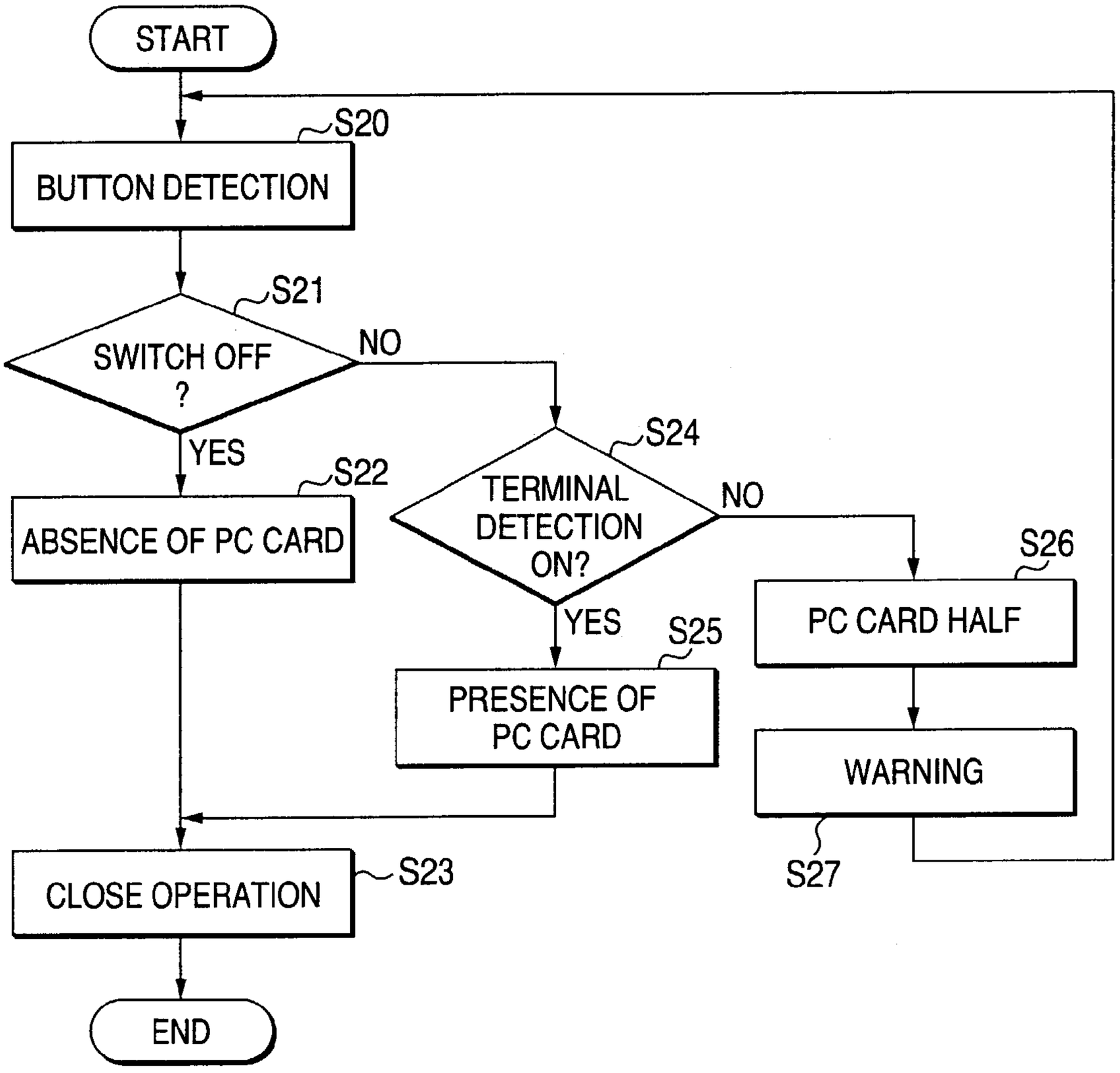

START
S20
BUTTON DETECTION
S21
SWITCH OFF ?
NO
YES
S22
ABSENCE OF PC CARD
S24
TERMINAL DETECTION ON?
NO
YES
S25
PRESENCE OF PC CARD
S26
PC CARD HALF
WARNING
S27
CLOSE OPERATION
S23
END

FIG. 7

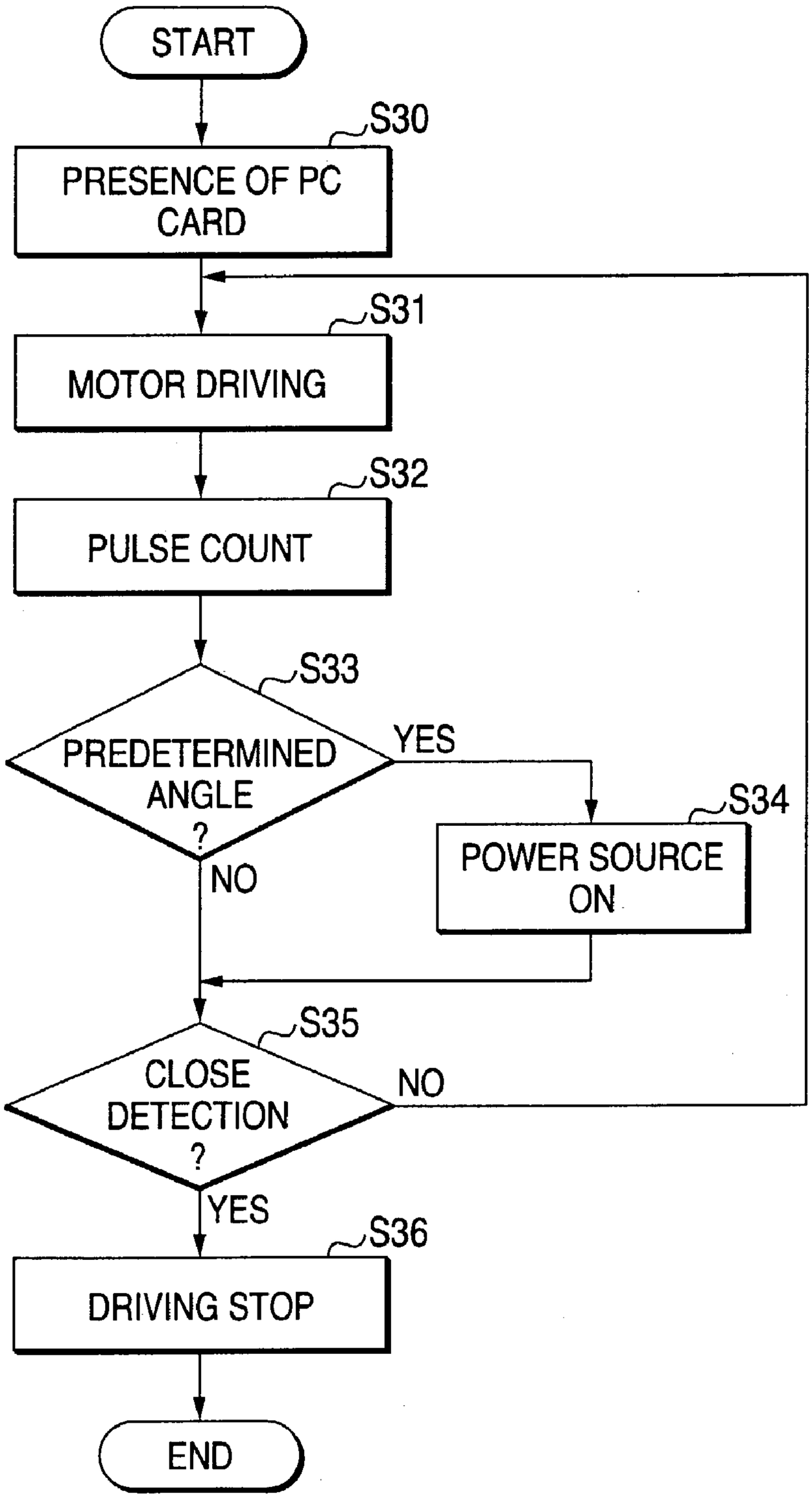

START
S30
PRESENCE OF PC CARD
S31
MOTOR DRIVING
S32
PULSE COUNT
S33
PREDETERMINED ANGLE ?
YES
NO
S34
POWER SOURCE ON
S35
CLOSE DETECTION ?
NO
YES
S36
DRIVING STOP
END

FIG. 8A

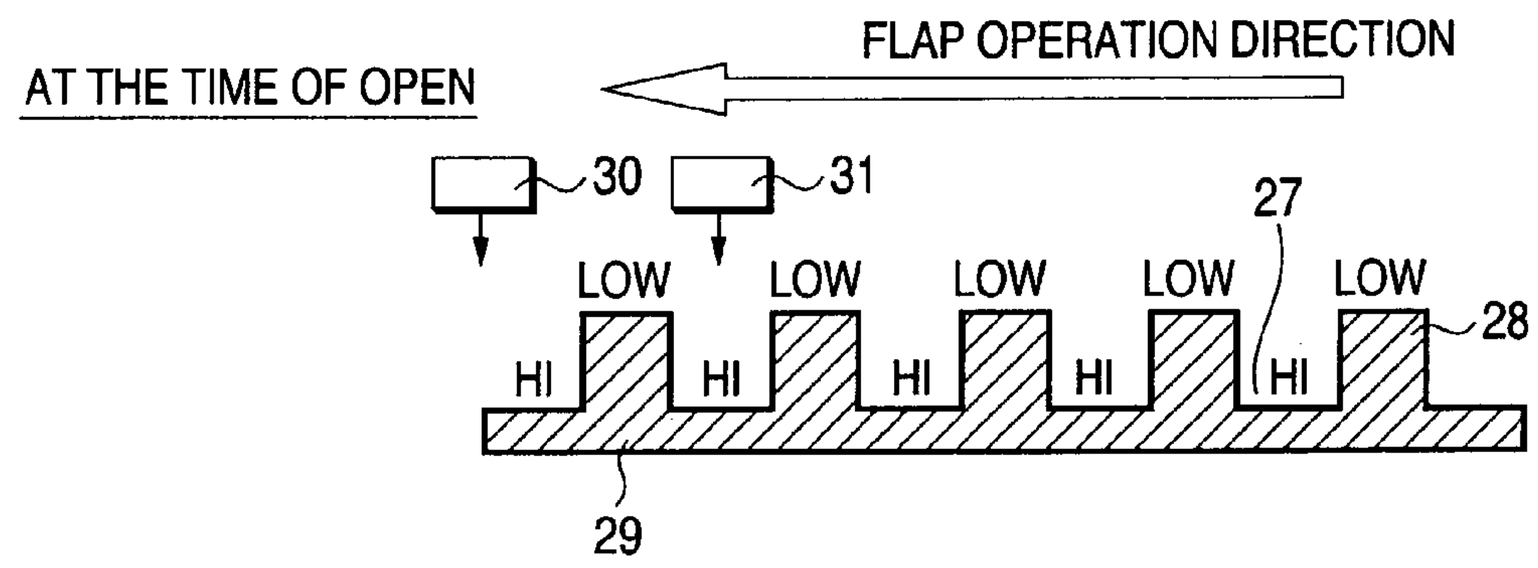

FLAP OPERATION DIRECTION
AT THE TIME OF OPEN
30
31
27
LOW
LOW
LOW
LOW
LOW
28
HI
HI
HI
HI
HI
29

FIG. 8B

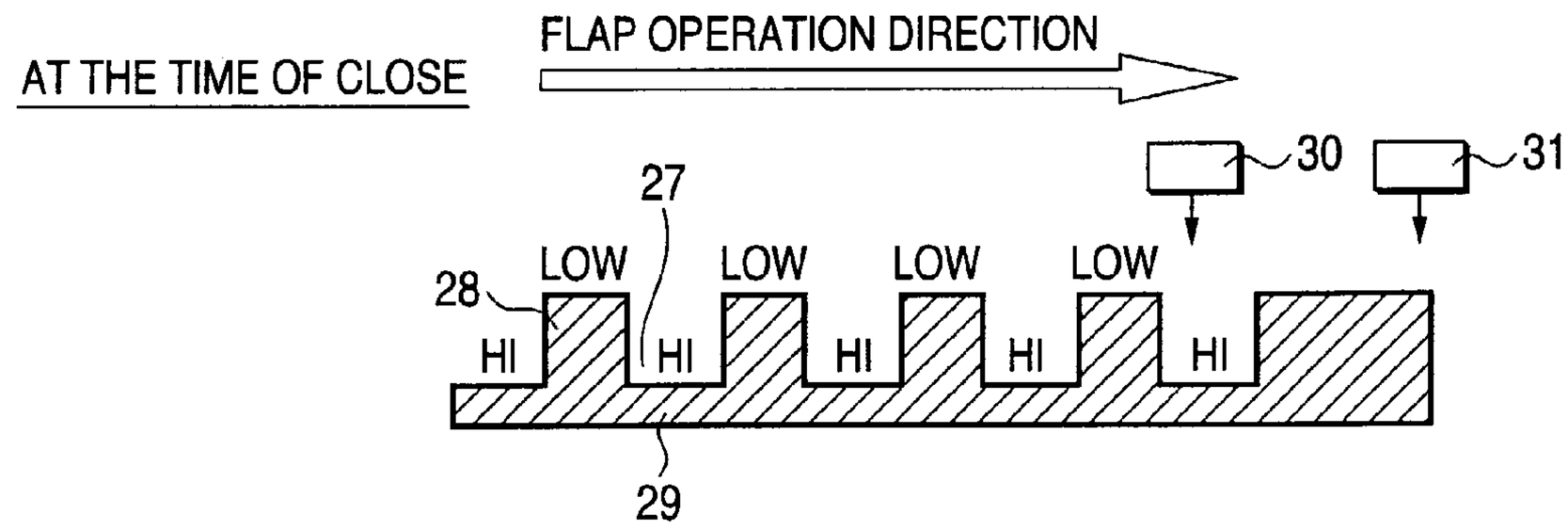

FLAP OPERATION DIRECTION
AT THE TIME OF CLOSE
30
31
27
28
LOW
LOW
LOW
LOW
HI
HI
HI
HI
HI
29

FIG. 9A

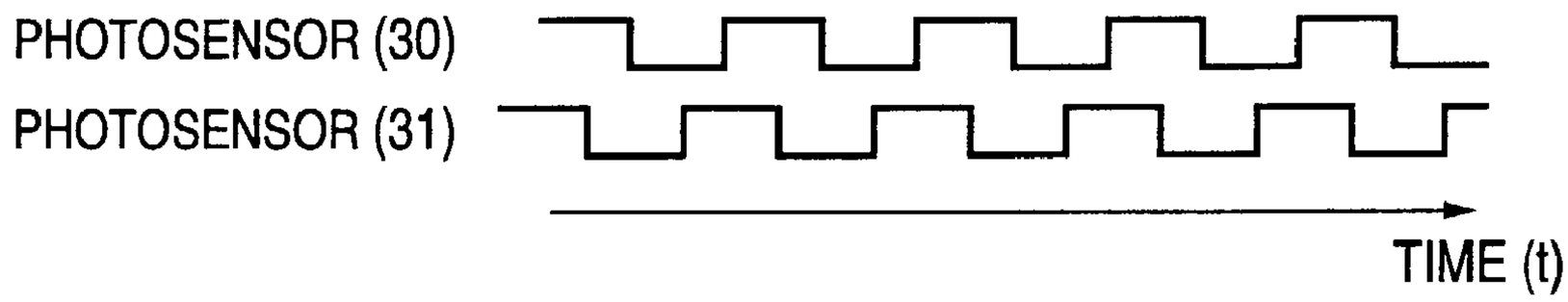


FIG. 9B

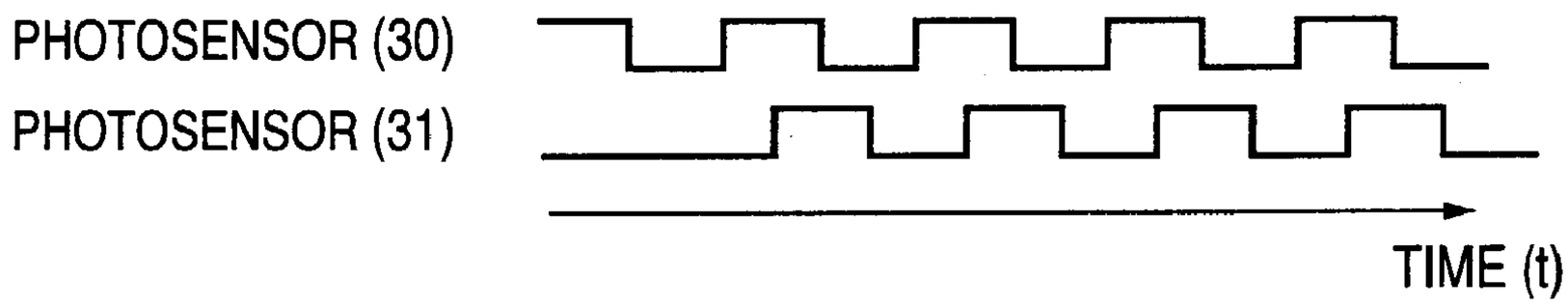
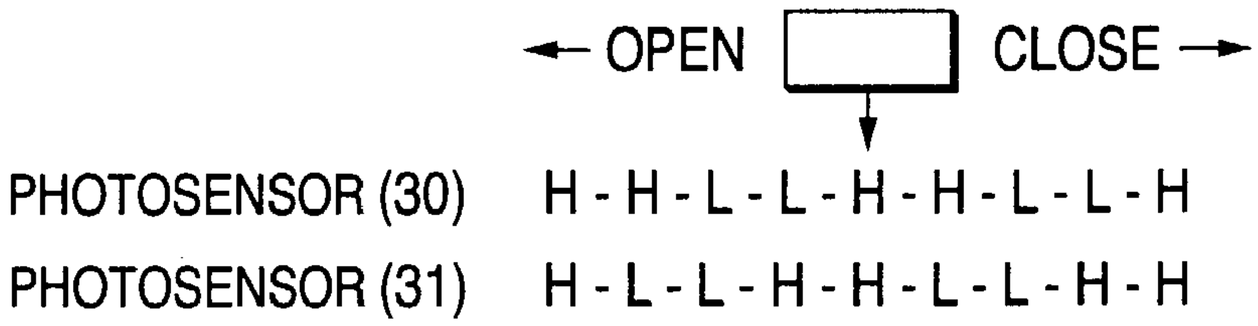


FIG. 10



ELECTRONIC APPARATUS, POWER CONTROL OF ELECTRONIC APPARATUS AND MOVING METHOD OF FRONT PANEL OF ELECTRONIC APPARATUS

The present disclosure relates to the subject matter contained in Japanese Patent Application No. 2002-125140 filed on Apr. 26, 2002, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electronic apparatus, a power control method of an electronic apparatus and a moving method of a front panel of an electronic apparatus, and particularly to an electronic apparatus, a power control method of an electronic apparatus and a moving method of a front panel of an electronic apparatus capable of opening and closing an openable and closable front panel provided in the front of a record medium storage portion.

2. Description of the Related Art

In an electronic apparatus such as a vehicle-mounted AV (audio-video) apparatus, there is an apparatus having a moving device of a record medium such as a CD, a DVD, a card type record medium. Further, there is an apparatus having an openable and closable front panel in the front of such a vehicle-mounted AV apparatus.

In the vehicle-mounted AV apparatus providing such a front panel, there was conventionally no apparatus providing a card slot for inserting a card type record medium based on TYPE I or TYPE II in conformity with PCMCIA standards.

On the other hand, there is an apparatus providing such card slot in a notebook-sized personal computer or in its peripheral device. The card slot provided in such an apparatus is constructed so that an eject button is placed at the side of an insertion hole for a card type record medium and by pushing the eject button, insertion and ejection of the card type record medium are enabled.

However, in case that the eject button is pushed by mistake when in a state of supplying a power to the card type record medium, the state so-called energization, a data stored in the card type record medium may fails electrically. Therefore, various ideas are provided so that insertion and ejection of the card cannot be performed during energization.

Conventionally, in order to prevent the electrical failure, a lamp is provided to indicate that the card type record medium is in the energization, or a warning message is provided by a sound or a video indication on a display. However, those ideas are not perfect for protecting the card from the electrical failure.

It is considered effective by providing a manually controllable power switch at the side of an insertion hole for the card and mechanically interlocked with an eject button, so that unless the power switch is turned off, the eject button is locked and cannot be pushed.

However, even in this case, one needs to operate the power switch manually and operationality becomes bad. Also, in such a manual power switch, its structure becomes large, and there occurs a problem that it is unsuitable for an apparatus requiring savings in space, particularly for a vehicle-mounted apparatus.

Also, in a case that the front panel is closed when the card is imperfectly inserted into a slot, so-called half inserted state, the front panel makes contact with the card and affects a smooth opening and closing operations of the front panel.

SUMMARY OF THE INVENTION

The invention is implemented in view of the circumstances described above, and an object of the invention is to provide an electronic apparatus, a power control method of an electronic apparatus and a moving method of a front panel of an electronic apparatus capable of protecting an apparatus body and a card type record medium in the case of inserting or ejecting the card type record medium to or from a record medium storage portion of an apparatus providing a front panel.

In order to achieve the object, according to a first aspect of the invention, there is provided an electronic apparatus including a body part having a record medium storage portion for storing at least a card type record medium insertable and ejectable from an insertion hole provided at a front surface thereof; a front panel provided at the front surface of the body part; a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation; a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to an closed state in which the front panel is raised upright and covers the front surface of the body part; and a power control section for controlling a power supplied to the card type record medium in conjunction with movement of the front panel.

According to the first aspect of the invention, in the case that the panel moving mechanism moves the support member forward and it is shifted to the opened state by tilting the front panel so that the front surface of the front panel turns upward and insertion of the card type record medium to the record medium storage portion is enabled, power control section controls a power supplied to the card type record medium in conjunction with movement of the front panel. As a result of this, in the case of inserting and ejecting the card type record medium to and from the record medium storage portion, power supply is stopped and the card type record medium can be inserted and ejected safely.

According to a second aspect of the invention, there is provided a electronic apparatus including: a body part having a record medium storage portion for storing at least a card type record medium insertable and ejectable from an insertion hole provided at a front surface thereof; a front panel provided at the front surface of the body part; a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation; a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to an closed state in which the front panel is raised upright and covers the front surface of the body part; a first detection section for detecting whether or not the card type record medium is inserted into the record medium storage portion; a second detection section for detecting whether or not the card type record medium is electrically connected to the electric apparatus; a determination section for determining an insertion state of the card type record medium based on a state detected by the first detection section and a connection state detected by the second detection section; and a movement control section

for controlling the panel moving mechanism based on the insertion state determined by the determination section.

According to the second aspect of the invention, the determination section determines an insertion state of the card type record medium based on a detected result as to whether or not the card type record medium has been inserted into the record medium storage portion by the first detection section and a detected result as to whether or not the card type record medium has been electrically connected to the electronic apparatus by the second detection section and movement control section controls the panel moving mechanism based on this determination result, so that opening and closing operations of the front panel can be performed in response to the insertion state of the card type record medium. As a result of this, the card type record medium can be inserted and ejected safely.

According to a third aspect of the invention, there is provided a power control method for an electronic apparatus having a body part having a record medium storage portion for storing at least a card type record medium insertable and ejectable from an insertion hole provided at a front surface thereof, a front panel provided at the front surface of the body part, a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation, and a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to an closed state in which the front panel is raised upright and covers the front surface of the body part, a method including: detecting a tilt state of the front panel based on a signal issued in conjunction with opening and closing operations of the front panel; stopping a power supplied to the card type record medium when determined that either the insertion hole or an operation part for ejecting the card type record medium from the record medium storage portion provided at the front surface of the body part is exposed based on the detecting of the tilt state of the front panel.

According to the third aspect of the invention, in the case that the panel moving mechanism moves the support member forward and it is shifted to the opened state in which insertion of the card type record medium to the record medium storage portion is enabled by tilting the front panel so that the front of the front panel turns upward, supply of a power is stopped and controlled when it is decided that a tilt state of the front panel detected based on a signal issued in conjunction with opening and closing operations of the front panel is tilted to a state in which either an insertion hole of a record medium storage portion for ejectably storing at least a card type record medium or an operation part for ejecting the card type record medium from the record medium storage portion is exposed, so that power supply is always stopped in the case of inserting and ejecting the card type record medium. As a result of this, the card type record medium can be inserted and ejected safely.

According to a fourth aspect of the invention, there is provided a method for moving a front panel of an electronic apparatus having a record medium storage portion for storing at least a card type record medium insertable and ejectable from an insertion hole provided at a front surface thereof, a front panel provided at the front surface of the body part, a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation, and a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to an closed state in which the front panel is raised upright and covers the front surface of the body part, a method including: detecting whether or not the card type record medium is inserted into the record medium storage portion and whether or not the card type record medium is electrically connected to the electric apparatus, when moving the front panel to the closed state; determining that the card type record medium is not inserted properly when it is detected that the card type record medium is inserted into the record medium storage portion and that the card record medium is not electrically connected to the electronic apparatus; controlling the panel moving mechanism to stop when the card type record medium is not inserted properly.

According to the fourth aspect of the invention, the panel moving mechanism moves the support member backward and at the time of a closing operation of raising up the front of the front panel, it is detected whether or not the card type record medium has been inserted into the record medium storage portion and also it is detected whether or not the card type record medium has been electrically connected to the body part, and it is determined that the card type record medium has not been inserted properly when it is determined that the card type record medium has been inserted and has not been electrically connected, and the panel moving mechanism is to be stopped and the closing operation of the front panel is stopped. As a result of this, the card type record medium which has not been inserted properly can be prevented from interfering with the front panel.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and advantages of the present invention will become more apparent by describing in detail preferred exemplary embodiments thereof with reference to the accompanying drawings, wherein:

FIG. **1** is a view describing a vehicle-mounted AV apparatus according to an embodiment of the invention and is a front view showing a state in which a front panel is opened;

FIG. **2** is a view describing the vehicle-mounted AV apparatus and is a front view showing a state in which the front panel is closed;

FIG. **3** is a side view describing a front panel moving mechanism of the vehicle-mounted AV apparatus;

FIG. **4** is a block diagram of a control part of the vehicle-mounted AV apparatus;

FIG. **5** is a flowchart showing a power control method for controlling a power supplied to a card type record medium at the time of shifting the front panel of the vehicle-mounted AV apparatus to an opened state;

FIG. **6** is a flowchart showing a moving method for detecting half insertion of the card type record medium at the time of shifting the front panel of the vehicle-mounted AV apparatus to a closed state and moving the front panel;

FIG. **7** is a flowchart showing a power control method for controlling the power supplied to the card type record medium at the time of shifting the front panel of the vehicle-mounted AV apparatus to the closed state;

FIG. **8**A is an explanatory diagram showing a relation between a scale member and photo sensors at a time of an opening operation of the front panel in the embodiment, and FIG. **8**B is an explanatory diagram at the time of a closing operation of the front panel;

FIG. **9**A is a drawing showing a sample of a pulse signal generated at the time of the opening operation of the front panel in the embodiment, and FIG. **9**B is a drawing showing a sample of a pulse signal generated at the time of the closing operation of the front panel; and

FIG. **10** is a two-bit signal based on the pulse signal shown in FIGS. **9**A and **9**B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the accompanying drawings, An embodiment according to the invention will be described below.

FIGS. **1** and **2** are views describing a vehicle-mounted AV apparatus according to an embodiment of the invention.

As shown in FIGS. **1** and **2**, the AV apparatus **11** has a moving device of a CD (or may be a DVD), an MD and a card slot, and provides an openable and closable front panel **13** provided in the front of an AV apparatus body **12** which is a body part, and FIG. **1** shows a state in which the front panel **13** is opened, and FIG. **2** shows a state in which the front panel **13** is closed. This front panel **13** is opened and closed using a panel moving mechanism described later.

In a state in which the front panel **13** is opened, as shown in FIG. **1**, a CD insertion hole **14** and a CD eject button **15** are exposed to the upper part of the front and a card type record medium insertion hole **16** acting as an insertion hole and a card type record medium eject button **17** which is an operation part for ejectment are exposed thereunder and an MD insertion hole **18** and MD eject button **19** are exposed thereunder.

Incidentally, a storage device (such as a hard disk which is not shown) for storing information about other media or storing information about map data necessary in the case of further combining a car navigation function with the AV apparatus **11** can be built into the inside of a lid **20** of the left side of the card type record medium insertion hole **16**.

In a card slot **21** which is a record medium storage section, a card type record medium based on TYPE I or TYPE II in conformity with PCMCIA standards can be inserted from the insertion hole **16**. Further, various record media of other standards can be inserted through a conversion adapter.

When inserting media such as the CD, the card type record medium, the MD into the AV apparatus body **12**, the media are inserted by opening the front panel **13**. Also, in the case of ejecting each of the media, the media can be ejected from the AV apparatus body **12** by pushing each of the eject buttons **15**, **17**, **19**.

Each of the insertion holes **14**, **16**, **18** of the CD, the card type record medium, the MD is provided sequentially from the upper part of the AV apparatus body **12**. As a result of this, in the case of inserting each of the media, it is unnecessary to open the front panel **13** to a state in which all the insertion holes are visible (a fully opened state). That is, it may be constructed so that the front panel **13** is opened to an angle of a state in which the insertion hole **14** of the CD is visible in the case of inserting or ejecting the CD and it is opened to an angle of a state in which the insertion hole **16** of the card type record medium is visible in the case of inserting or ejecting the card type record medium and it is opened to an angle of a state in which the insertion hole **18** of the MD is visible in the case of inserting or ejecting the MD.

Further, it may be provided so that a display, which functions as a display section and a notification section, is provided on a surface of the front panel **13** and displays a warning of insertion or ejection of the CD, the card type record medium, the MD. Also, such display may be used for displaying an image of a car navigation, a DVD video, or a TV.

Next, a panel moving mechanism **10***a* for opening and closing the front panel **13** will be described by referring to FIG. **3**. FIG. **3** is a side view describing the panel moving mechanism **10***a* of the front panel **13** of the vehicle-mounted AV apparatus **11**. Incidentally, in FIG. **3**, illustration of moving devices of the CD and the MD is omitted.

As shown in FIG. **3**, a sliding pin **22** is mounted in the upper end of the front panel **13** and this sliding pin **22** is constructed so as to vertically move along a vertical guide groove **24** provided in a frame **23** of the AV apparatus body **12**.

On the other hand, a rotating pin **25** is provided in the lower end of the front panel **13** and is rotatably mounted in the front end of a support member **26** provided movably in backward and forward directions (right and left directions in FIG. **3**) in the lower end of the AV apparatus body **12**.

Incidentally, in the inside of the support member **26**, a scale member **29** in which many recess parts **27** and protrusion parts **28** are provided alternately at regular pitches is provided so as to move integrally. Photo sensors **30**, **31** for detecting the recess parts **27** and the protrusion parts **28** which are signal generation section are provided over the scale member **29** at predetermined intervals.

Also, a moving motor **32** for opening and closing the front panel **13** by moving the support member **26** backward and forward is provided in the back (right in FIG. **3**) of the support member **26**.

Therefore, the moving motor **32** moves the support member **26** backward and forward through a movement mechanism (not shown) and thereby the front panel **13** is opened and closed. At this time, it is constructed so that the photo sensors **30**, **31** detect the recess parts **27** and the protrusion parts **28** of the scale member **29** to issue a pulse signal and an angle of opening and closing of the front panel **13** can be detected from this pulse signal.

Next, a control part for controlling a power supplied to a card type record medium of a vehicle-mounted AV apparatus according to the embodiment and a panel moving mechanism will be described. FIG. **4** is a block diagram showing a configuration of a control part **10**.

As shown in FIG. **4**, the control part **10** comprises a CPU **33** which is determination section, a microcomputer **34** which is moving control section, a switch **35**, which is first detection section, of the card type record medium insertion hole **16**, a terminal **36** for connection detection, which is second detection section, of the card type record medium, a power switch **39**, the eject button **17**, a front panel operation button **37**, the front panel **13**, the front panel moving motor **32**, a pulse generator **38** which is signal generation section, an opened state (OPEN) detection switch **40**, and a closed state (CLOSE) detection switch.

The CPU **33** controls the power switch **39** of the card type record medium. Also, by detecting states of the switch **35** of the card type record medium insertion hole and the terminal **36** (for example, one pin of a connector in conformity with PCMCIA standards) for connection detection of the card type record medium, the presence or absence of a card type record medium **21***a* or a state in which the card type record medium **21***a* has been imperfectly inserted and has not been connected electrically, that is, a state in which the card type record medium has not been inserted properly (hereinafter also called half insertion) is detected.

The microcomputer **34** detects the front panel operation button **37**, and controls the front panel moving motor **32**, and recognizes and controls an angle of the front panel **13** obtained by counting the number of pulses generated by the pulse generator **38**.

The switch **35** is provided in the card type record medium insertion hole **16**, and detects whether or not the card type record medium **21***a* has been inserted into the cards lot **21**. That is, the switch **35** is provided in a position capable of detecting the presence of the card type record medium **21***a* even in a state in which the card type record medium **21***a* has not been connected to a connector of the card slot **21**.

The front panel operation button **37** is placed on the front panel **13**, and a user directly operates opening and closing operations the front panel. When closed, the front panel **13** covers the insertion hole **16** of the card slot **21** or the eject button **17** of the card slot **21**, and when opened, the insertion hole **16** of the card type record medium becomes insertable state and the eject button **17** becomes an operable state.

The pulse generator **38** generates a pulse signal by detecting the recess parts **27** and the protrusion parts **28** of the scale member **29** connected to the front panel **13** by the photo sensor **30**, and sends the pulse signal to the microcomputer **34**.

The power switch **39** is a switch of a power supplied to the card type record medium **21***a*. The opened state (OPEN) detection switch **40** detects that the front panel **13** has fully opened. Also, the closed state (CLOSE) detection switch **41** detects that the front panel **13** has closed.

At the time of an opening operation to an opened state of the front panel **13**, the control part **10** constructed thus controls a power supplied to the card type record medium **21***a* in conjunction with movement of the front panel **13** and detects a tilt state of the front panel **13** based on a signal of the pulse generator **38** (signal generation section) for generating a signal in conjunction with opening and closing operations of the front panel **13** and controls the power supplied to the card type record medium **21***a*.

Also, the control part **10** controls the switch **35** (first detection section) for detecting whether or not the card type record medium **21***a* has been inserted into the card slot **21**, the terminal **36** for connection detection (second detection section) for detecting whether or not the card type record medium **21***a* has been electrically connected to the AV apparatus **11**, the CPU **33** (determination section) for determining an insertion state of the card type record medium **21***a* based on a state detected by the switch **35** and a state detected by the terminal **36** for connection detection, and the panel moving mechanism **10***a* based on a result of the determination.

Next, a power control method and a front panel moving method of an electronic apparatus according to the embodiment will be described below with reference to FIGS. **5** to **7**.

FIG. **5** is a flowchart showing a power control method for controlling a power supplied to a card type record medium at the time of shifting the front panel **13** to an opened state, and FIG. **6** is a flowchart showing a moving method for detecting half insertion of the card type record medium at the time of shifting the front panel **13** to a closed state and moving the front panel, and FIG. **7** is a flowchart showing a power control method for controlling the power supplied to the card type record medium at the time of shifting the front panel **13** to the closed state.

First, a power control method for controlling a power supplied to a card type record medium at the time of shifting the front panel **13** to an opened state will be described with reference to the flowchart shown in FIG. **5**.

A user first pushes the front panel operation button **37** in a state in which the front panel **13** is fully closed. As shown in FIG. **5**, when the microcomputer **34** detects an input of the front panel operation button **37** (step S**10**), the moving motor **32** is actuated by control of the microcomputer **34** (step S**11**) and the support member **26** and the scale member **29** are advanced and an opening operation of the front panel **13** is started.

At the time of the opening operation, the photo sensors **30**, **31** detect the recess parts **27** or the protrusion parts **28** of the scale member **29** as shown in FIG. **8**A and send a pulse signal as shown in FIG. **8**B to the microcomputer **34** and count pulses (step S**12**).

The microcomputer **34** calculates an angle of the front panel **13** in operation by multiplying a front panel operating angle per one pulse stored previously by the number of pulses received (step S**13**) and recognizes the angle constantly.

Then, the angle of the front panel **13** is compared with a predetermined angle preset (step S**14**) and when it is decided that the front panel **13** reaches the predetermined angle, that fact is transferred to the CPU **33** by a signal from the microcomputer **34**.

Here, the predetermined angle means an angle at which first of either the insertion hole **16** of the card type record medium **21***a* or the eject button **17** (operation part) of the card type record medium is exposed.

When it is decided that the front panel **13** reaches the predetermined angle in step S**14**, the CPU **33** controls the power switch **39** and turns off a power supplied to the card type record medium **21***a* (step S**15**).

Next, the microcomputer **34** decides whether or not it is detected that the front panel **13** has become in a fully opened state (step S**16**) and when it is detected that it has not become in the fully opened state yet, the flowchart returns to step S**11** and the moving motor **32** is actuated to continue the opening operation.

When it is detected that the front panel **13** has become in the fully opened state, the moving motor **32** is stopped (step S**17**).

In this manner, when the front panel **13** reaches the predetermined angle, a power of the card type record medium **21***a* is turned off before it becomes in a state in which inserting and ejecting operations of the card type record medium **21***a* can be performed, so that the card type record medium **21***a* can be protected electrically in the case of ejecting the card type record medium **21***a* from the AV apparatus body **12**.

Next, detection of a state in which a card type record medium has not been inserted properly (half insertion) and moving control of a front panel will be described with reference to the flowchart shown in FIG. **6**.

When the front panel operation button **37** is pushed in a fully opened state of the front panel **13**, the front panel **13** attempts to perform a closing operation, but in case that the card type record medium **21***a* is in a half insertion state, there may cause a situation in which the front panel **13** makes contact with the card type record medium **21***a*. Because of this, it is necessary to detect an insertion state of the card type record medium **21***a* and detect the half insertion.

First, a user pushes the front panel operation button **37** in an opened state in which the front panel **13** has fully opened. As shown in FIG. **6**, when the microcomputer **34** detects an input of the front panel operation button **37** (step S**20**), the microcomputer **34** transfers its input to the CPU **33**.

The CPU **33** decides the presence or absence of the card type record medium **21***a* by the switch **35** of the card type record medium insertion hole **16** (step S**21**). The switch **35** is physically pushed by the card type record medium **21***a* to become ON in the case of inserting the card type record medium **21***a* into the insertion hole **16**, so that it is detected that the card type record medium **21***a* is present.

When the switch **35** is OFF, it is recognized that the card type record medium **21***a* is absent (step S**22**) and a closing operation of the front panel **13** is started (step S**23**).

On the other hand, when the switch **35** is ON, it is recognized that the card type record medium **21***a* is present. At this time, it is decided whether or not the card type record medium **21***a* has been inserted normally by detecting whether or not a terminal of the card type record medium **21***a* has been electrically connected to a terminal of a connector of the card slot **21** (step S**24**).

When the terminal of the card type record medium **21***a* has been electrically connected to the terminal of the connector of the card slot **21**, it is recognized that the card type record medium **21***a* has been inserted normally (step S**25**) and a closing operation of the front panel **13** is started (step S**23**).

On the other hand, when the terminal of the card type record medium **21***a* has not been electrically connected to the terminal of the connector of the card slot **21** in step S**24**, it is recognized that the card type record medium **21***a* is in a half insertion state (step S**26**) and a closing operation is not performed and a warning, for example, "insert the card type record medium normally" is given by sound and/or video (step S**27**). Incidentally, this warning may be visually displayed on a display provided in a surface of the front panel **13**.

Thus, when the card type record medium **21***a* is in the half insertion state, the closing operation is not started, so that a situation in which the front panel **13** makes contact with the card type record medium **21***a* can be prevented.

Next, a power control method for controlling a power supplied to a card type record medium at the time of shifting the front panel **13** to a closed state will be described with reference to the flowchart shown in FIG. **7**.

A user first pushes the front panel operation button **37** in an opened state in which the front panel **13** has fully opened. When it is detected that the card type record medium **21***a* has been inserted normally (step S**30**), it is evident that the front panel **13** does not interfere with the card type record medium **21***a* even in the case of closing the front panel **13**, so that the microcomputer **34** controls the moving motor **32** (step S**31**) and closes the front panel **13**.

At this time, the photo sensors **30**, **31** detect the recess parts **27** or the protrusion parts **28** of the scale member **29** as shown in FIG. **8**B and send a pulse signal as shown in FIG. **9**B to the microcomputer **34** and count pulses (step S**32**).

The microcomputer **34** calculates an angle of the front panel **13** in operation by multiplying a front panel operating angle per one pulse stored previously by the number of pulses received and recognizes the angle constantly.

Then, the angle of the front panel **13** is compared with a predetermined angle preset (step S**33**) and when it is decided that the front panel **13** is closed to the predetermined angle, that fact is transferred from the microcomputer **34** to the CPU **33** and the CPU **33** controls the power switch **39** and turns on a power supplied to the card type record medium **21***a* (step S**34**).

Here, the predetermined angle means an angle at which both the insertion hole **16** of the card type record medium **21***a* and the eject button **17** (operation part) of the card type record medium fully hide.

Until the microcomputer **34** detects a fully closed state by the closed state detection switch **41** (step S**35**), the moving motor **32** is actuated to continue a closing operation and when the fully closed state is detected, the moving motor **32** is stopped (step S**36**).

As described above, in the embodiment, the switch for controlling a power of the card slot **21** does not require a physical structure, so that savings in space can be achieved.

Also, since moving power control of the card type record medium **21***a* is automatically performed at an angle of the front panel **13** incapable of operating the insertion hole **16** of the card slot **21** or the eject button **17**, a user can be prevented from inserting or ejecting the card type record medium **21***a* by mistake even though a power of the card slot **21** has been turned on.

Also, in the electronic apparatus, the power control method of the electronic apparatus and the moving method of the front panel of the electronic apparatus according to the embodiment, an insertion state of the card type record medium **21***a* is detected using the switch **35** of the insertion hole **16** of the card slot **21** and the terminal **36** for connection detection prepared for the card slot **21** and when a state in which it has not been inserted properly (half insertion) is detected, a closing operation of the front panel **13** is not performed, so that with respect to not only the card type record medium **21***a* in conformity with PCMCIA standards but also all the record media capable of using a conversion adapter corresponding to a card type record medium TYPE I or TYPE II, a physical failure of the front panel **13** or the record medium due to contact at the time of moving the front panel or a electrical failure of the record medium can be prevented.

Incidentally, the electronic apparatus, the power control method of the electronic apparatus and the moving method of the front panel of the electronic apparatus according to the invention are not limited to the embodiment described above, and proper changes and improvements can be made. For example, in the embodiment described above, the CPU **33** and the microcomputer **34** are provided separately, but they can be replaced with one CPU or microcomputer having both functions.

Also, in the embodiment described above, the description is made as the power control method in the vehicle-mounted AV apparatus and the moving method of the front panel of the electronic apparatus, but as long as there is an apparatus having a card slot and an openable and closable front panel in the front, it is not limited to the vehicle-mounted AV apparatus and can also be applied to other electronic apparatus.

As described above, in accordance with an electronic apparatus according to the first aspect of the invention, in the case that a panel moving mechanism moves a support member forward and it is shifted to an opened state by tilting a front panel so that the front of the front panel turns upward and insertion of a card type record medium to a record medium storage portion is enabled, power control section controls a power supplied to the card type record medium in conjunction with the movement of the front panel. As a result of this, in the case of inserting and ejecting the card type record medium to and from the record medium storage portion, power supply is stopped and the card type record medium can be inserted and ejected safely.

Also, the signal is issued from signal generation section in conjunction with opening and closing operations of the front panel, so that a tilt state of the front panel can be detected based on the signal sent. The power control section controls a power to a card type record medium based on the detected tilt state of the front panel, so that the card type record medium can be inserted and ejected safely.

Also, the power supplied to the card type record medium is stopped by the time when either an insertion hole of the record medium storage portion or an operation part for ejecting the card type record medium inserted is exposed at the time of an opening operation of the front panel, so that it can surely be prevented from ejecting the card type record medium by mistake even though a power has not stopped, and the card type record medium can be inserted and ejected safely.

Also, the determination section determines an insertion state of the card type record medium based on a detected result as to whether or not the card type record medium has been inserted into the record medium storage portion by first detection section and a detected result as to whether or not the card type record medium has been electrically connected to the electronic apparatus by second detection section and moving control section controls a panel moving mechanism based on this determination result, so that opening and closing operations of the front panel can be performed in response to the insertion state of the card type record medium. As a result of this, the card type record medium can be inserted and ejected safely.

Also, in accordance with an electronic apparatus according to the second aspect of the invention, the determination section decides that the card type record medium has not been inserted normally when the first detection section detects that the card type record medium has been inserted into the record medium storage portion and the second detection section detects that the card type record medium has not been electrically connected, and opening and closing operations of the front panel by the panel moving mechanism are stopped, so that a situation in which the front panel makes contact with the card type record medium can be avoided.

Also, the information about an insertion state of the card type record medium is displayed by display section on the basis of a determination result of the determination section based on the detected results by the first detection section and the second detection section, so that it can properly cope with the case of stopping the panel moving mechanism.

Also, when the determination section determines that the card type record medium has not been inserted properly, a warning is issued by notification section, so that a user can reinsert the card type record medium.

Also, in accordance with a power control method of an electronic apparatus according to the third aspect of the invention, in the case that the panel moving mechanism moves the support member forward and it is shifted to the opened state in which insertion of the card type record medium to the record medium storage portion is enabled by tilting the front panel so that the front of the front panel turns upward, supply of a power is stopped and controlled when it is decided that a tilt state of the front panel detected based on a signal issued in conjunction with opening and closing operations of the front panel is tilted to a state in which either an insertion hole of a record medium storage portion for ejectably storing at least a card type record medium or an operation part for ejecting the card type record medium from the record medium storage portion is exposed, so that power supply is always stopped in the case of inserting and ejecting the card type record medium. As a result of this, the card type record medium can be inserted and ejected safely.

Also, in accordance with a moving method of a front panel of an electronic apparatus according to the fourth aspect of the invention, the panel moving mechanism moves the support member backward and at the time of a closing operation of raising up the front of the front panel, it is detected whether or not the card type record medium has been inserted into the record medium storage portion and also it is detected whether or not the card type record medium has been electrically connected to the body part, and it is determined that the card type record medium has not been inserted properly when it is determined that the card type record medium has been inserted and has not been electrically connected, and the panel moving mechanism is stopped and the closing operation of the front panel is stopped. As a result of this, the card type record medium which has not been inserted properly can be prevented from interfering with the front panel.

Although the present invention has been shown and described with reference to specific preferred embodiments, various changes and modifications will be apparent to those skilled in the art from the teachings herein. Such changes and modifications as are obvious are deemed to come within the spirit, scope and contemplation of the invention as defined in the appended claims.

What is claimed is:

1. An electronic apparatus comprising:

a body part having a record medium storage portion for storing at least a card record medium insertable and ejectable from an insertion hole provided at a front surface thereof;

a front panel provided at the front surface of the body part;

a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation;

a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to a closed state in which the front panel is raised upright and covers the front surface of the body part;

a power control section for controlling a power supplied to the card record medium in conjunction with movement of the front panel; and

a signal generating section for generating a signal in conjunction with opening and closing operations of the front panel,

wherein the power control section detects a tilt state of the front panel based on the signal and controls the power supplied to the card record medium.

2. The electronic apparatus as claimed in claim **1**,

wherein the power control section stops supplying the power to the card record medium by the time when either the insertion hole or an operation part for ejecting the card record medium from the record medium storage portion provided at the front surface of the body part is exposed at the time of an opening operation of the front panel.

3. An electronic apparatus comprising:

a body part having a record medium storage portion for storing at least a card record medium insertable and ejectable from an insertion hole provided at a front surface thereof;

a front panel provided at the front surface of the body part;

a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation;

a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to a closed state in which the front panel is raised upright and covers the front surface of the body part;

a first detection section for detecting whether or not the card record medium is inserted into the record medium storage portion;

a second detection section for detecting whether or not the card record medium is electrically connected to the electric apparatus;

a determination section for determining an insertion state of the card record medium based on a state detected by the first detection section and a connection state detected by the second detection section; and

a movement control section for controlling the panel moving mechanism based on the insertion state determined by the determination section.

4. The electronic apparatus as claimed in claim **3**,

wherein the determination section determines that the card record medium is not inserted properly when the first detection section detects that the card record medium is inserted into the record medium storage portion and the second detection section detects that the card record medium is not electrically connected, and

the movement control section controls the panel moving mechanism to stop when the determination section determines that the card record medium is not inserted properly.

5. The electronic apparatus as claimed in claim **3**, further comprising:

a display section for displaying information relevant to the insertion state or the connection state determined by the determination section.

6. The electronic apparatus as claimed in claim **3**, further comprising:

a notification section for providing a notification that the cart record medium is not inserted properly when the determination section determines that the insertion state is improper.

7. A power control method for an electronic apparatus having a body part having a record medium storage portion for storing at least a card record medium insertable and ejectable from an insertion hole provided at a front surface thereof, a front panel provided at the front surface of the body part, a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation, and a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to a closed state in which the front panel is raised upright and covers the front surface of the body part, a method comprising:

detecting a tilt state of the front panel based on a signal issued in conjunction with opening and closing operations of the front panel; and

stopping a power supplied to the card record medium when determined that either the insertion hole or an operation part for ejecting the card record medium from the record medium storage portion provided at the front surface of the body part is exposed based on the detecting of the tilt state of the front panel.

8. A method for moving a front panel of an electronic apparatus having a record medium storage portion for storing at least a card record medium insertable and ejectable from an insertion hole provided at a front surface thereof, a front panel provided at the front surface of the body part, a support member attached to a lower end of the front panel and supports the front panel rotatably by using the lower end of the front panel as the center of rotation, and a panel moving mechanism for moving the support member in forward and backward directions, thereby moving the front panel to an opened state in which the front panel is tilted so that a front surface of the front panel turns upward and the front surface of the body part to be exposed, and to a closed state in which the front panel is raised upright and covers the front surface of the body part, a method comprising:

detecting whether or not the card record medium is inserted into the record medium storage portion and whether or not the card record medium is electrically connected to the electric apparatus, when moving the front panel to the closed state;

determining that the card record medium is not inserted properly when it is detected that the card record medium is inserted into the record medium storage portion and that the card record medium is not electrically connected to the electronic apparatus; and

controlling the panel moving mechanism to stop when the card record medium is not inserted properly.

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